EXPLANATION

UNCONSOLIDATED TO SEMI-CONSOLIDATED

QUATERNARY

Qal

Alluvium (0.5-6m. thick)

Interbedded, poorly-sorted country rock and vein quartz gravels, quartzose sands, micaceous silts and kaolinitic clays. Typically confined to flood plains of perennial streams in valleys and gathering areas dissected by ephemeral streams in upland areas. Sediment size and mineralogy are directly related to the adjacent country rock and geomorphic setting. In rural, deeply dissected areas, alluvium may be mixed with fine to very coarse colluvium. In urban areas this unit cannot be adequately shown since it is commonly overlain by artificial fill and/or has been severely disturbed.

Structural symbols on alluvium represent bedrock exposures in stream valleys. These are typically either along the margins of the flood plain or close to the main channel of the drainage.

Qac

Colluvium and Alluvium (0.5-6m. thick)

Unsorted, massive clays to gravels interbedded with poorly-sorted alluvial(?) sands and gravels. Defined on the basis of lithology, geomorphic setting and soil series.

Unconformity

CRETACEOUS(?)

ps pc

Potomac Group (?) (0.5-10m. thick)

Unconsolidated to locally cemented sediments identical with Lower Cretaceous Patuxent Formation sands and clays mapped elsewhere. The sediment caps, however, lack palynological data and are isolated from the continuous Coastal Plain sequence to the east.

ps *Sand-gravel lithofacies. Poorly to well sorted quartz sands containing variable amounts of vein quartz and quartzite gravel. Framework components are commonly coated with ferric oxides and are locally limonite-cemented. Variable amounts of silt and clay are present in lenses, pods and as matrix. Sands are typically planar to cross-bedded, where exposed below the soil zone. Pebbles commonly range from 1 to 10 cm. in diameter and are concentrated in coarse planar beds or are disseminated in finer sediments.*

pc *Clay-silt lithofacies. Gray to brown, massively bedded to poorly laminated kaolinitic clay to clayey silt. Delineated in this quadrangle by auger borings and soil series.*

unconformity

INTRUSIVE ROCKS

SILURIAN(?)*

p

Pegmatite

Massive, coarse-grained to very coarse-grained, light colored rock comprised of muscovite, quartz, and feldspar.

PRECAMBRIAN(?)*

sl

Slaughterhouse Gneiss

Medium-grained, locally massive, orange-weathering biotite-muscovite-microcline-quartz-plagioclase gneiss.

top of crystalline stratigraphic section

BALTIMORE MAFIC COMPLEX

m

Mount Washington Amphibolite

Fine- and medium-grained, generally massive, dark rock consisting of hornblende and plagioclase, and locally, pyroxene. Includes very subordinate (less than 10%) actinolite schist or fels, most commonly as very thin layers (3 cm or less). Variations in hornblende/plagioclase ratio define in places a layering ranging from a few centimeters to more than a decimeter thick. Weathers to a clay-rich, red saprolite enclosing numerous residual cobbles and boulders.

thrust fault

CAMBRO-ORDOVICIAN(?)

GLENARM SUPERGROUP

WISSAHICKON GROUP

os o s

Oella Formation

o *Oella Formation. Fine- to medium-grained biotite-plagioclase-muscovite-quartz schist, locally garnetiferous and chloritic, with subordinate interlayered fine-grained biotite-plagioclase-quartz gneiss or fels (metagraywacke) in beds ranging from a few centimeters to two decimeters in thickness.*

s *serpentinite. Bluish-black, chromite-bearing serpentinite with amphibole and sparse relict olivene and pyroxene. Intricately and irregularly fractured and slickensided. Veined by white magnesite, chalcedony, calcite, deweylite, chrysotile, and common opal. Locally talc -rich.*

os *Sweathouse Amphibolite Member. Fine-grained epidote amphibolite, commonly laminated, with subordinate interlayered schist and gneiss (described above).*

l(g) l(g-k) ea a q lr m l(g-s)

Loch Raven Schist

l *Loch Raven Schist. Uniform, medium- to coarse-grained biotite-plagioclase-muscovite-quartz schist with lenticles and pods of vein quartz. Locally rich in biotite and feldspar. Includes rare quartzite.*

(g) *garnet facies. Garnet common; staurolite and kyanite rare or absent.*

(g-s) *garnet-staurolite facies. Garnet and staurolite common; kyanite rare or absent.*

(g-k) *garnet-kyanite facies. Garnet and kyanite common; staurolite rare or absent.*

(g-s-k) *garnet-staurolite-kyanite facies. Garnet, staurolite, and kyanite all common.*

ea *epidote amphibolite. Concordant zones of thin-bedded epidote amphibolite ranging from fine-grained to coarse-grained and from finely laminated to uniform. Quartz usually associated with epidote. Locally includes thin beds of quartzite.*

a *amphibolite. Similar to above but with epidote rare or absent.*

q *quartz. Massive, milky vein quartz.*

lr *Rush Brook Member. Fine- to medium-grained, slabby weathering biotite-plagioclase-muscovite-quartz schist, commonly less micaceous and more gneissic, with very subordinate quartzite in layers one to two decimeters or less in thickness. Rarely garnetiferous, but commonly bearing accessory tourmaline.*

m *marble*

c cpl cld clm c cml

Cockeysville Marble

Contacts between members of the Cockeysville Marble are interpreted as facies boundaries.

c *Cockeysville Marble undivided.*

clm *Layered marble member. Metalimestone and metadolostone interlayered generally on a scale of one meter. Metalimestone commonly medium-grained and moderately silicate-rich (chiefly phlogopite), but may be finer-grained or quite pure. Metadolostone generally finer-grained than associated metalimestone, and generally silicate-rich (chiefly phlogopite and tremolite) and calcite-bearing, but locally quite pure. Outcrops commonly weather to a carbonate sand with embedded metadolostone boulders.*

cld *Layered metadolostone member. Pure, white metadolostone interlayered on a scale of several decimeters with dark metadolostone containing silicate minerals, mainly diopside (commonly as stubby porphyroblasts), tremolite, phlogopite, and quartz. The darker metadolostone locally contains small patches of calcite (less than one cm in longest dimension), and, in the northern body accessory pyrite. Many outcrops in the northern body are partially disintegrated to dolomite sand.*

c *calc-silicate fels. Massive rock consisting of diopside, tremolite, quartz, and calcite.*

cpl *Phlogopitic metalimestone member. Fine- to medium-grained, millimeter- to centimeter-scale interlayered white to bluish-white calcite marble, and purplish, phlogopitic calcite marble or calc-schist with quartz, muscovite, scapolite, feldspar, and accessory diopside and tremolite. Locally, uniformly silicate-rich or silicate- poor. A few outcrops in the Ruxton area include metadolostone. In the vicinity of Moores Branch includes zones of schist of undetermined thickness identical to the schist of sg.*

cml *Massive metalimestone member. Medium- and coarse-grained, commonly blue-streaked, massive, clean calcite marble. Silicates sparse, and, where present, are chiefly phlogopite with some muscovite, quartz, and tremolite. Includes subordinate fine-grained metalimestone, and very subordinate fine-grained metadolostone, generally silicate-rich, and in zones ranging from a few centimeters to a few tens of meters thick.*

sgs s sg sq

Setters Formation

s *Undifferentiated sg and sq.*

sgs *Garnet schist member. Uniform, medium-grained biotite-plagioclase-muscovite-quartz schist with abundant garnet accompanied by either abundant staurolite or kyanite but rarely both.*

sg *Gneiss member. Fine- and medium-grained schists with a variable biotite/muscovite ratio, locally approaching a gneissic texture. Clots of biotite typically give the rocks a distinctive spotted appearance.*

sq *Quartzite member. Thin-bedded, medium-grained biotite-muscovite-microcline-quartz schist and fine-grained, slabby-weathering muscovite-microcline quartzite, both commonly bearing tourmaline.*

unconformity

PRECAMBRIAN*

p€bl p€bs p€bh p€ba

Baltimore Gneiss

p€bl *Layered gneiss member. Dark and light biotite-microcline-quartz-plagioclase gneiss interlayered generally on a centimeter to decimeter scale; may vary from biotite schist to quartz-feldspar granofels. Locally bears muscovite, and rarely hornblende. Includes augen gneiss in places. Complexly deformed locally.*

p€bs *Streaked-augen gneiss member. Uniform, medium-grained biotite-microcline-quartz-plagioclase gneiss generally bearing augen that have a stretched appearance; magnetite abundant in places; minor garnet and hornblende locally. Subordinate, fine-grained, dark biotite-quartz-feldspar gneiss generally in layers less than one meter thick.*

p€bh *Hornblende gneiss member. Similar to the layered gneiss member described above, but with hornblende-bearing dark gneiss constituting about 50% of the total outcrop area. Garnet very rare.*

p€ba *Augen gneiss member. Similar to the layered gneiss member described above, but containing large (1-3 cm), light-colored ovoids (augen) consisting either of feldspar or feldspar and quartz.*

sz *silicified zone. Massive, silicified, brecciated rock, locally with quartz-crystal-lined vugs.*

For the crystalline rocks primary minerals are listed in order of increasing abundance. Grain size definitions are: fine = less than 1 mm; medium = 1-5 mm; coarse = 5 mm to 3 cm; very coarse = greater than 3 cm.

contact
Generally approximate or inferred. Distribution and concentration of structural symbols is an approximate measure of the reliability of any contact.

boundary between mineral facies of the Loch Raven Schist

U D

normal fault
U - upthrown side
D - downthrown side

thrust fault
teeth on upper plate

axial trace of anticline or dome

vertical inclined horizontal

foliation or schistosity
(everywhere virtually parallel to compositional layering)

symmetric | dextrally asymmetric | sinistrally asymmetric

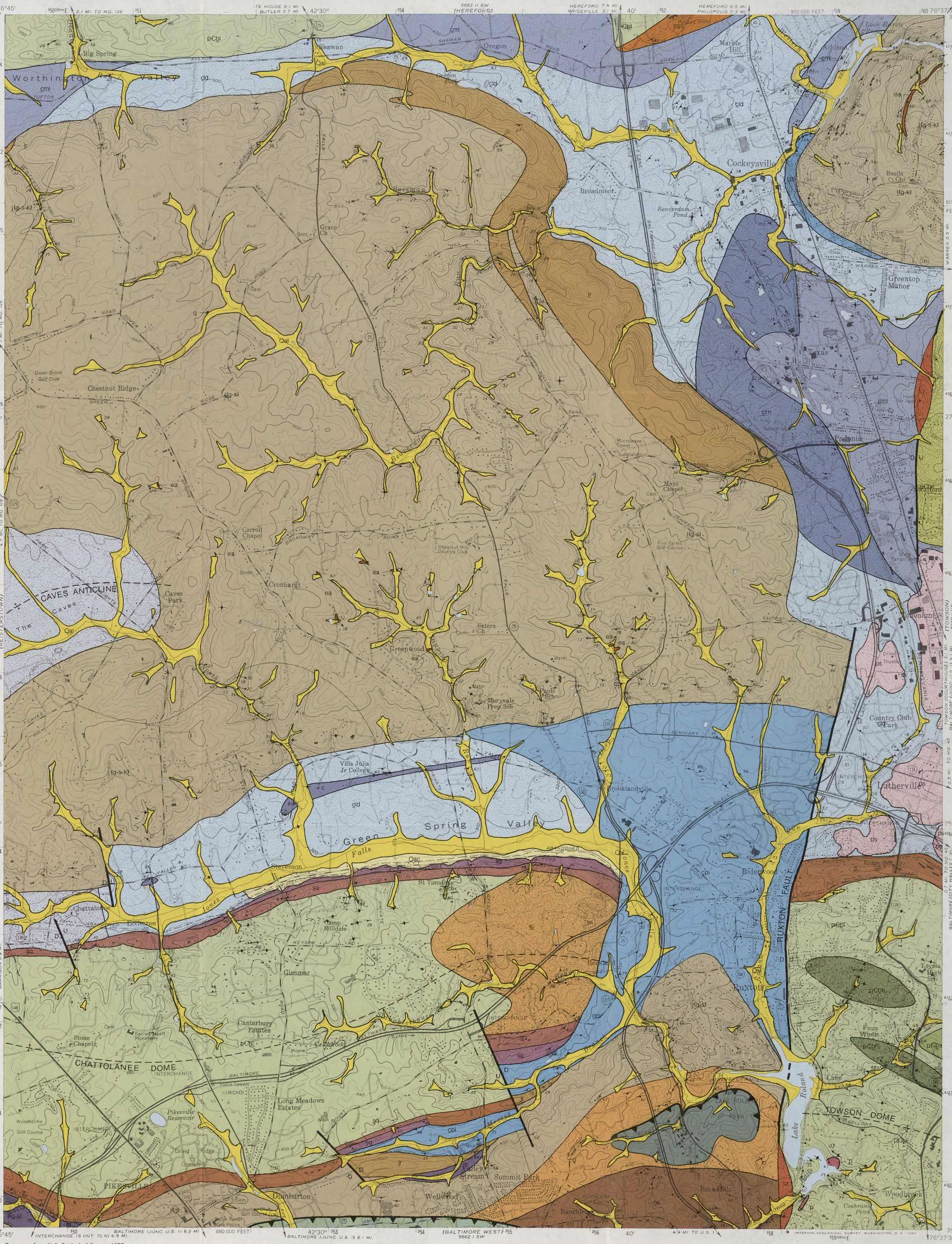
inclined | horizontal

axis and symmetry of minor fold

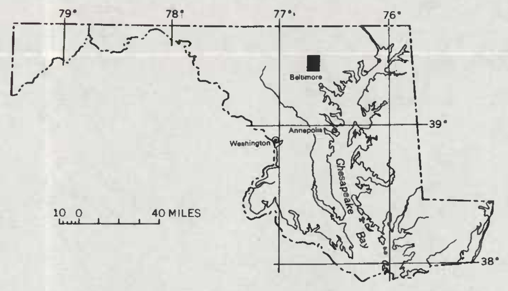
inclined | horizontal

mineral lineation

*Age designations based on radiometric dates on *Geologic Map of Maryland*(1968).



QUADRANGLE LOCATION



Base map from U.S. Geological Survey, 1957 (photorevised 1966) Cockeysville Quadrangle 7½ Minute Series

Crystalline rocks mapped by William P. Crowley; sediments by Juergen Reinhardt and Emery T. Cleaves.

Field mapping done, 1972-1975.

Map drafted by
Karen R. Kuff and
Margaret P. Ketcham

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

Copies of Atlas available from
Maryland Geological Survey
Johns Hopkins University
Baltimore, Maryland 21218

COCKEYSVILLE QUADRANGLE: GEOLOGY, HYDROLOGY AND MINERAL RESOURCES

MAP 1. GEOLOGIC MAP OF THE COCKEYSVILLE QUADRANGLE, MARYLAND

By

William P. Crowley, Juergen Reinhardt and Emery T. Cleaves

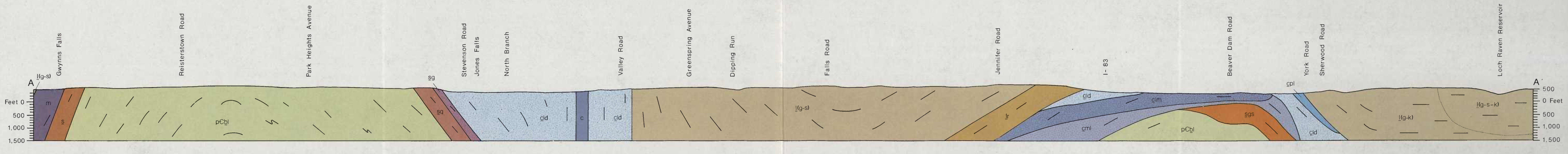
1975

UTM GRID AND 1966 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

CHATTOLANEE DOME



CROSS SECTION A - A': Horizontal scale same as map scale, no vertical exaggeration.
Discontinuous lines indicate trace of foliation.

EXPLANATION

Overburden consists of saprolite, soil, and sediments, and overlies bedrock. The diagonal hatchured pattern on the map shows areas where sediments overlie rock and/or saprolite. Elsewhere, soil and saprolite mantle the crystalline rocks. The thickness of the soil and saprolite which mantles the rock has been estimated from rock and saprolite exposures, water well data, rock weathering characteristics, and rock weathering models (Cleaves, 1973; Cleaves, Godfrey, and Bricker, 1970). These data have been integrated through landform maps to provide estimates of overburden thickness (Cleaves and Godfrey, 1973, p. 148; Cleaves, Crowley, and Kuff, 1974).

REFERENCES CITED:

Cleaves, E. T., 1973, Chemical weathering and landforms in a portion of Baltimore County, Md.; Ph.D. dissertation, The Johns Hopkins University, Baltimore, Md., 104 p.

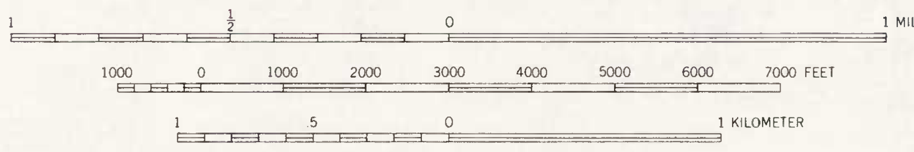
Cleaves, E. T., Crowley, W. P., and Kuff, K. R., 1974, Towson Quadrangle, geologic and environmental atlas: Md. Geol. Survey.

Cleaves, E. T., and Godfrey, A. E., 1973, Geologic constraint maps for planning purposes in the Piedmont of Maryland: Geol. Soc. Am., Abstracts with Programs, v. 5, no. 2, p. 148.

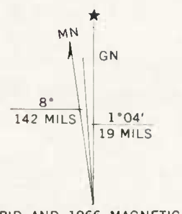
Cleaves, E. T., Godfrey, A. E., and Bricker, O. P., 1970, Geochemical balance of a small watershed and its geomorphic implications: Geol. Soc. Am. Bull., v. 81, p. 3015-3032.

UNIT	OVERBURDEN THICKNESS	COMMENTS
	0-5 feet	Rock exposures common. Includes areas where slope exceeds 12 degrees. Also encompasses areas of shallow overburden where slopes are relatively flat (Green Spring Valley and Lake Roland Park).
	5-20 feet	Overburden thinnest at base of slopes and thickens upslope. Locally, depth may exceed 20 feet. Corestones (residual boulders) common in overburden overlying geologic units p€bl and p€bs)
	greater than 20 feet	Residual boulders and slabs occur rarely in upper 20 feet.
	variable	Abrupt local changes in overburden thickness. Because of weathering characteristics of Cockeysville Marble rock pinnacles and residual boulders are common in some areas; elsewhere overburden substantially exceeds 20 feet.
	variable	Overburden includes sediment and residiuum on marble. Thickness cannot be estimated.
	variable	Abrupt local changes in overburden thickness on Baltimore Gneiss. Bedrock and residual boulders exposed at surface in some areas; in other areas, drilling data indicate overburden in excess of 20 feet.
	variable	In broad valleys alluvial sediments 2 to 20 feet or more in thickness may be present. In narrow valleys (adjacent to heavily stippled area) between steep slopes bedrock is at or near surface. In upland areas (adjacent to lightly stippled area) bedrock may vary from 0 to 20 feet or more beneath the surface, and colluvial deposits of low density and bouldery alluvium may be present. High water table. Part or all of area may be subject to flooding.

SCALE 1:24000



CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL



UTM GRID AND 1966 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

Copies of Atlas available from
Maryland Geological Survey
Johns Hopkins University
Baltimore, Maryland 21218

Base map from U.S. Geological Survey, 1957 (photorevised 1966) Cockeysville Quadrangle 7½ Minute Series

Map drafted by
Margaret P. Ketcham

Williams & Heintz Map Corporation, Washington, D.C. 20027

COCKEYSVILLE QUADRANGLE: GEOLOGY, HYDROLOGY AND MINERAL RESOURCES

MAP 2. ESTIMATED THICKNESS OF OVERBURDEN

By

Emery T. Cleaves

1975

EXPLANATION

TERRAIN UNDERLAIN BY CRYSTALLINE ROCK

Geologic factors affecting land modification in the crystalline rock portion of the quadrangle are keyed, firstly, to the depth of the weathered material (saprolite) which mantles the rock, and secondly, to stream valleys. The parameters of five and 20 feet for overburden thickness were selected to reflect current needs for placement of on-site sewage disposal systems that are commonly installed in subdivisions. To construct a system using a tile field, at least five feet of overburden is desirable; for a system using dry wells, 20 feet or more of overburden is desirable. As a consequence, areas with less than five feet of saprolite overlying the crystalline rock are indicated as areas of maximum constraint. Not only are such areas of shallow overburden poor sites for construction of on-site sewage systems, but also are areas where significant rock blasting would probably be required in various construction activities. Areas with estimated overburden between five and 20 feet present an intermediate constraint situation in comparison to areas with less than five feet of overburden and those areas with more than 20 feet. From a construction or earth-moving point of view, areas with estimated overburdens in excess of 20 feet present minimal geologic constraints. Stream valleys in the crystalline rock areas are indicated as areas of maximum constraint. High water table conditions result in numerous bogs, swamps, and generally poor surface drainage conditions. Part or all of the area may be subject to flooding.

TERRAIN UNDERLAIN BY SEDIMENTARY DEPOSITS

Geologic constraints in the areas underlain by sedimentary deposits are keyed to lithology (clay, sand-gravel) rather than thickness of overburden. Where construction activities penetrate through the sediments into the underlying saprolite and crystalline rock, geologic constraints necessarily reflect the crystalline rock conditions. In the Lutherville-Timonium area, where sediments of varying thickness overlie marble, crystalline rock terrain constraints may more strongly influence man's modification of the land than sedimentary terrain constraints.

CAUTION: The general conditions and constraints represented on this map cannot replace or substitute for on-site investigation of specific land tracts prior to their modification.

TERRAIN UNDERLAIN BY CRYSTALLINE ROCK

MAXIMAL CONSTRAINT CONDITIONS

High water table conditions. Part or all of area may be subject to flooding.

Overburden estimated at 0-5 feet in thickness. Includes areas with slopes greater than 12^{o}. Mantle instability may occur if slope is disturbed.

Overburden estimated at 0-5 feet in thickness. Slope of the land generally less than 12^{o}, and may be less than 6^{o}.

INTERMEDIATE CONSTRAINT CONDITIONS

Variable thickness of overburden. Terrain is underlain by Cockeysville Marble; abrupt local changes in overburden thickness; rock pinnacles and residual boulders commonly occur; overburden commonly is a sandy carbonate residium.

Variable thickness of overburden. Terrain is underlain by Baltimore Gneiss. Slopes generally between 6 to 12^{o}, locally exceed 12^{o}. Rocks and residual boulders exposed at surface in some areas. Drilling data indicate overburden in excess of 20 feet in other areas, some of which are adjacent to rock outcrops. Overburden composed of quartz-clay minerals-ferric oxides and hydroxides.

Overburden estimated 5 to 20 feet in thickness. Saprolite composed of quartz, clay minerals, ferric oxides and hydroxides. Rock fragments rare to common, depending upon parent material.

MINIMAL CONSTRAINTS

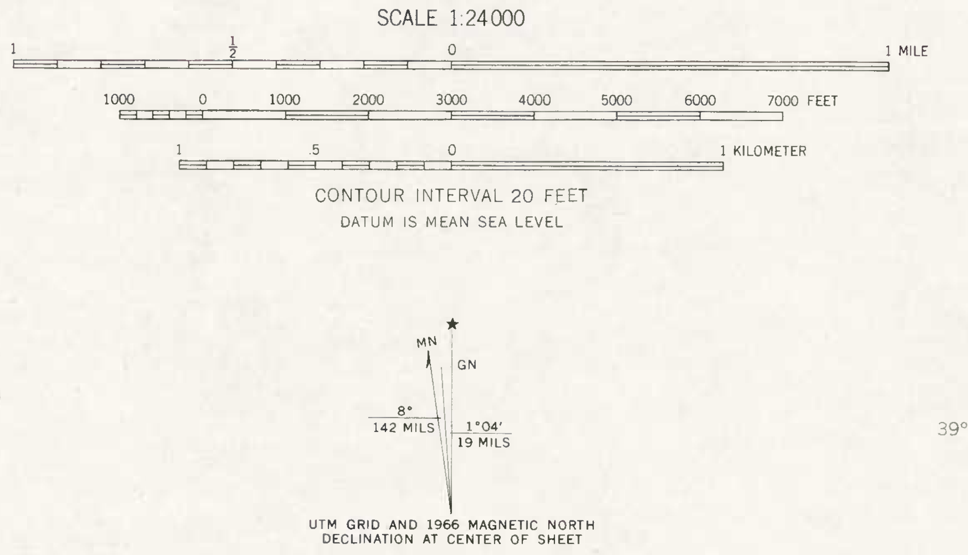
Depth of overburden estimated to exceed 20 feet. Slopes less than 12^{o} and commonly less than 6^{o}. Saprolite composed of quartz-clay minerals-ferric oxides and hydroxides, with the exception of The Caves, where a silt to sandy carbonate residium from weathering of marble occurs.

TERRAIN UNDERLAIN BY SEDIMENTARY DEPOSITS

Areas in which sand and gravel predominate. Excavation characteristics and stability of cut slopes are variable due to abrupt horizontal and vertical changes in distribution of sand-gravel and clay. Ground water seepage in predominantly sand layers results in severe slope erosion. After periods of prolonged precipitation localized perched water table conditions are common, particularly if clay seams and lenses are present. On the other hand, excavations or cut slopes through dry sand may result in bank failures triggered by vibration. Sediments are underlain by marble which will hamper construction activities if excavation penetrates through the sedimentary cover.

Areas in which clay predominates. Excavation characteristics and stability of cut slopes are variable due to abrupt horizontal and vertical changes of clay and sand-gravel. Cut slopes and vertical banks in clay may be stable over short periods of a few days. However, jointing in the clay commonly results in bank failure if cut is left open for an extended period. Sediments are underlain by marble which will hamper construction activities if excavation penetrates through the sedimentary cover.

Areas in which gravel, sand, and clay of fluvial origin are mixed together with poorly sorted, low density materials of colluvial origin. Bank failures may occur if land is modified by construction.



Base map from U.S. Geological Survey, 1957 (photorevised 1966) Cockeysville Quadrangle 7½ Minute Series

Map drafted by
Margaret P. Ketcham

Williams & Heintz Map Corporation, Washington, D.C. 20027

COCKEYSVILLE QUADRANGLE: GEOLOGY, HYDROLOGY AND MINERAL RESOURCES

MAP 3. GEOLOGIC FACTORS AFFECTING LAND MODIFICATION

By

Emery T. Cleaves

1975

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

Copies of Atlas available from
Maryland Geological Survey
Johns Hopkins University
Baltimore, Maryland 21218

EXPLANATION

The purpose of this map is to delineate resources of economic value; whether of past, present or potential use. In the past, the primary mineral industry in the quadrangle was the production of building stone, some crushed stone, agricultural lime, copper, chrome, and iron ore. In 1975, calcite, carbonate sand, and crushed stone from the Cockeysville Marble constitute the resources being utilized. Deposits that could be used in the future include crushed stone from other rock types described below and building stone from the Setters Formation and the Cockeysville Marble. However, this area is rapidly being urbanized, so the amount of potentially available mineral resources is dwindling.

PRESENT AND POTENTIAL RESOURCES

MARBLE

The only mineral resource in the Cockeysville quadrangle currently being excavated is the Cockeysville Marble (c). The Campbell Quarry at Texas, one of the nation's largest crushed stone operations, and the Arundel Corporation's Quarry on Greenspring Avenue south of the Beltway are the only two operators working the Cockeysville marble. In the Texas-Cockeysville area the marble was extracted for building stone as early as 1829. In 1847, 13 working quarries were reported, the largest of these was the Beaver Dam marble quarry which supplied most of Baltimore's famous white marble steps. The marble was also used to build the Washington Monument in Baltimore and the Washington Monument in Washington, D.C. Most of these old quarries have blended into the landscape, having been abandoned long ago. Some are filled with water and provide good swimming holes.

The Cockeysville Marble ranges in composition from a pure calcite marble to a dolomitic marble and in many places is streaked with phlogopite. The non-stratified marble unit (m) can also be considered as potential sources for usable crystalline limestone. The marbles can be used for crushed stone, building stone, mineral filler, agricultural lime when finely ground, roofing granules and as a white aggregate. Some sources might even be pure enough for chemical use. At the Texas quarry, dolomitic sand is also being extracted as a multi-purpose sand.

CRUSHED STONE

West of Rockland in the Cockeysville quadrangle is a large body of Slaughterhouse gneiss (sl). The less schistose gneisses in Baltimore County have been worked for building stone in the past, but this body of gneiss has not been touched. It is a coarse grained rock and contains, among other minerals, feldspar and mica which tend to cleave easily. Other sources of crushed stone could be the Mt. Washington Amphibolite (m), and two non-stratigraphic units: calc-silicate fels (c) and a silicified zone (sz). The Mt. Washington Amphibolite is a dark, massive rock that could be used as trap rock. The non-stratified rocks are both massive and should have good strength characteristics for crushed stone due to their structural and mineralogical composition. These rocks offer a good potential source for crushed stone. The deposit of serpentinite at Bare Hills could also be excavated for crushed stone although the amount of available stone is limited by past excavations and present development.

SETTERS FORMATION

The quartzite (sq), gneiss (sg) and the undifferentiated (s) members of the Setters Formation have all been quarried in the past. In the southern part of the quadrangle, there are several overgrown quarries which once produced attractive stone for numerous buildings in the Baltimore area. The Setters Formation has a rectangular fracture pattern, producing a hard, rough construction block. The quartzite of the Setters Formation is called flagstone due to its tendency to cleave into neat, parallel-sided slabs, good for either flagging or general building stone. The color of the stone varies from a light buff to a dark brown, giving a pleasing effect when used. It could also be used for crushed stone.

PEGMATITES

In the Baltimore vicinity the pegmatites (p) were once worked for feldspar and crushed stone. These still provide a viable resource of crushed stone. Concentration of the pegmatites in the Cockeysville quadrangle, however, are too small to be considered a prospective source of crushed stone.

PAST RESOURCES

IRON ORES

There are five historic limonite ore banks in the Cockeysville quadrangle. They supplied some of the ore used by the Ashland Furnace when it operated from 1837 to 1880. The largest, most intensively worked area was the Oregon Ore Bank, now known as Oregon Ridge Swimming Club. The operation began in 1847 when the Oregon Furnace was erected on the site. The ore was later sent to the Ashland Furnace. Two smaller workings were the Caves Ore Bank in The Caves, consisting of two small openings, and the Cross Ore Bank, located one-half mile northwest of Stevenson. These iron deposits formed at the contacts between the Cockeysville Marble, the underlying Setters Formation, and the overlying Loch Raven Schist.

The other two openings were started in ore banks formed at the Potomac Group-Cockeysville Marble contact. The Rider Ore Bank in southern Lutherville was worked on a royalty by the Ashland Iron Company. It is now covered by the Baltimore Beltway. A similar, smaller opening was made 100 yards southwest of the old Timonium Station, but has since been obliterated by development.

SERPENTINITE

Serpentinite (s) was quarried intermittently in the Bare Hills district from 1890 to 1940. Five quarries were opened; the largest two can be found just north of the junction of Pimlico Road with Falls Road. These quarries once produced crushed stone for roads and concrete, building stone, and decorative stone including some verde antique. The serpentinite, ranging from light yellow to somber purplish-green, produces a rough construction block of dubious durability.

The first discovery of chromite in the United States occurred at Bare Hills around 1810. The ore was mined at several localities within the serpentinite area. It was reported to be rich in iron, and some crude ore was assayed as high as 60% Cr_2O_3. Until the 1880's production was reported to have been greater than 100 tons per year. Placer deposits were a second source of chromite. These were worked in stream valleys located on the eastern side of Falls Road within the Serpentinite body. The chromite was used for chemical compounds, pigments, and dyes; metallurgical uses had not yet been devised. Although ore is probably left in Bare Hills, apartment complexes have pre-empted the area. The Bare Hills Serpentinite body was also the earliest source of magnesite for Baltimore. The workings were extensive be-between 1814 and 1828. No traces of these remain.

COPPER

The largest copper mine in Maryland was established one-half mile south of the Bare Hills Serpentinite area. Although opened in 1845, its production did not peak until 1860. Very little evidence remains of the activity. Northeast of the main shaft (located just north of Smith Avenue), there were several piles of mine dump material and numerous prospect pits. South of Smith Avenue, just below the dirt road on the map, there was a small prospect hole that has since been covered by a golf course. The ore occurs in a hornblende gneiss which has been injected with pegmatite. The ore minerals were chalcopyrite, bornite, magnetite and some primary chalcocite yielding high grade (18%) copper. The last attempt to work the mine failed in 1908. There is reportedly copper still in the shaft. However, the Smith Avenue area is being rapidly covered by development which will prevent further mining.

REFERENCES

Hayden, H. H., 1833, Description of the Bare Hills near Baltimore: Am. Jour. Sci., 1st ser., v. 24, p. 349-360.

Knopf, E. B., 1922, Chrome ores of southeastern Pennsylvania and Maryland: U. S. Geol. Survey, Bull. 725, p. 85-99.

Mathews, E. B., 1898, An account of the character and distribution of Maryland building stones, together with a history of the quarrying industry: Md. Geol. Survey, v. 2, pt. 2, p. 125-241.

Mathews, E. B. and Grasty, J. S., 1909, Limestones of Maryland with special references to their use in the manufacture of lime and cement: Md. Geol. Survey, v. 8, pt. 3, p. 230-249.

Mathews, E. B. and Watson, E. H., 1929, The mineral resources of Baltimore County: in: Baltimore County, Md. Geol. Survey, p. 219-288.

Miller, W. J., 1905, The crystalline limestones of Baltimore County, Maryland: unpublished Ph.D. dissertation, The Johns Hopkins University.

Ostrander, C. W. and Price, W. E., 1940, Minerals of Maryland: Md. Nat. Hist. Society, p. 13-33.

Pearre, N. C. and Heyl, A. V., 1960, Chromite and other mineral deposits in serpentine rocks of the Piedmont upland, Maryland, Pennsylvania and Delaware: U. S. Geol. Survey, Bull. 1082-K.

———, 1965, Copper, zinc, lead, iron, cobalt, and barite deposits in the Piedmont upland of Maryland: Md. Geol. Survey, Bull. 28, p. 5-66.

Pearre, N. C., 1961, Mineral deposits of Maryland excluding fuels, sand, and gravel: U. S. Geol. Survey, Mineral Investigations Resource Map, MR-12.

Singewald, J. T., Jr., 1911, Report on the iron ores of Maryland, with an account of the iron industry: Md. Geol. Survey, v. 9, pt. 3, p. 121-325.

———, 1928, Notes on feldspar, quartz, chrome and manganese in Maryland: Md. Geol. Survey, v. 12, pt. 2, p. 93-194.

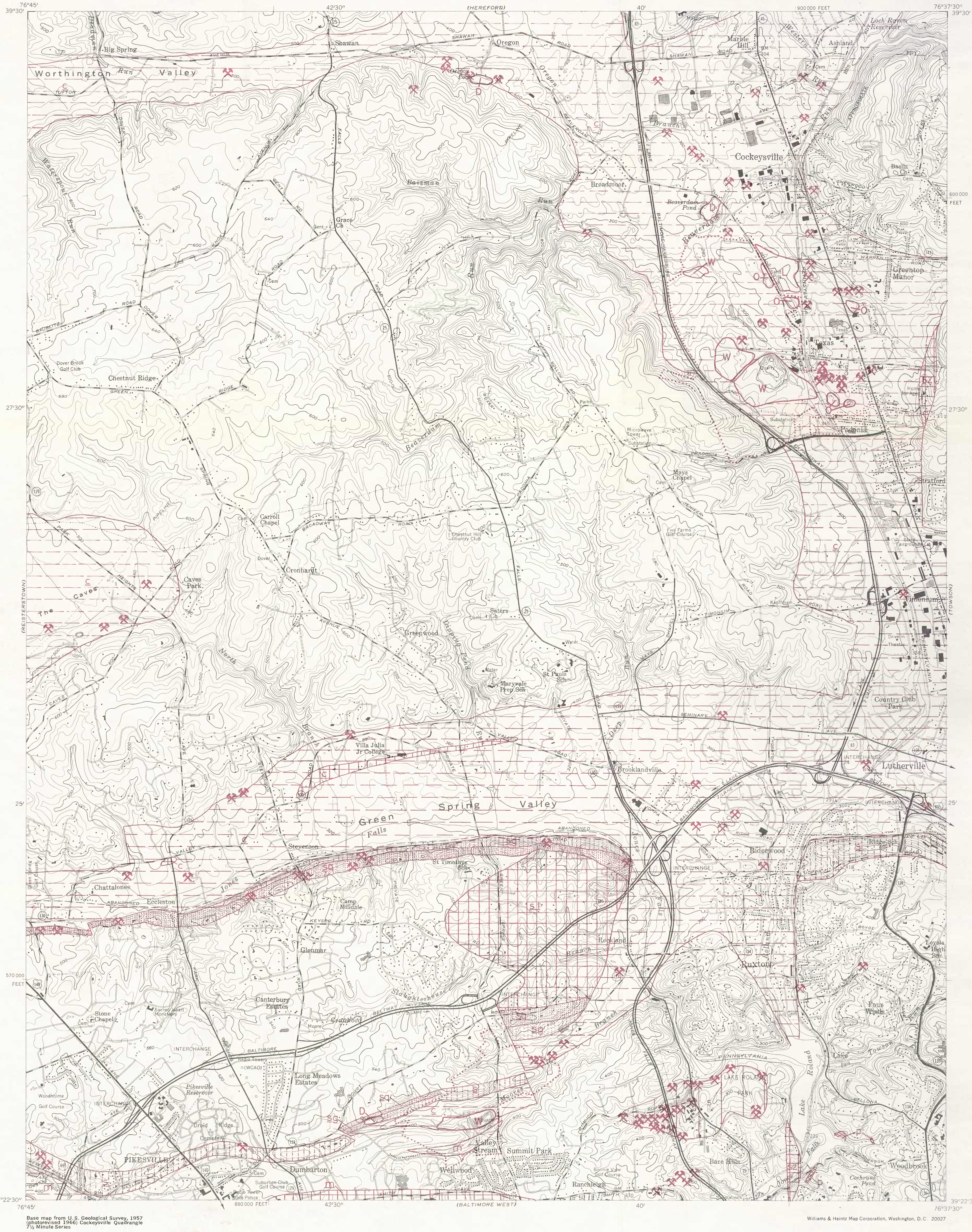
MAP UNITS

- marble
- crushed stone
- undifferentiated, gneiss, quartzite } Setters Formation
- pegmatite
- serpentinite

- small inactive quarry or mine } approximate locations
- site of former iron ore operation } approximate locations
- boundary of larger mineral operation
- boundary of property owned by mineral extractors

STATUS OF OPERATION

- W working
- D reclaimed or developed
- L landfill
- O overgrown, not reclaimed



Base map from U.S. Geological Survey, 1957 (photorevised 1966) Cockeysville Quadrangle 7½ Minute Series

Williams & Heintz Map Corporation, Washington, D.C. 20027

SCALE 1:24000

1 MILE

7000 FEET

1 KILOMETER

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1966 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

Copies of Atlas available from
Maryland Geological Survey
Johns Hopkins University
Baltimore, Maryland 21218

COCKEYSVILLE QUADRANGLE: GEOLOGY, HYDROLOGY AND MINERAL RESOURCES

MAP 4. MINERAL RESOURCES AND MINED LAND INVENTORY

By
Karen R. Kuff

1975

EXPLANATION

SUPPLEMENTAL RECORDS OF WELLS IN THE COCKEYSVILLE QUADRANGLE

Information for wells and test holes shown on the map is on file with the U.S. Geological Survey, Parkville, Maryland, and the Maryland Geological Survey, Baltimore, Maryland. Logs and well-construction records are available for most wells and for all test holes shown.

Well-numbering system: The wells and springs shown on the map are numbered according to a coordinate system in which Maryland counties are divided into 5-minute quadrangles of latitude and longitude. The first letter of the well number designates a 5-minute segment of latitude; the second letter designates a 5-minute segment of longitude. These letter designations are followed by a number assigned chronologically to wells. This letter-number sequence is the quadrangle designation, which is preceded by an abbreviation of the county name. Thus, well BA-DC 25 is the 25th well inventoried in quadrangle DC in Baltimore County. In reports describing wells in only one county, the county prefix letters are frequently omitted from the well number. However, the numbering system currently in use (1975) differs slightly from that used in earlier published reports, such as Dingman and Ferguson (1956). In the 1956 report, well BA-DC 25 was designated as Bal-Dc 25. The discontinuance of the use of lower-case letters in the well designation was necessitated by the change to a computer storage and retrieval system for well information in 1970.

Miscellaneous shallow bore holes or auger test holes are designated by a number followed by a "T". These holes are numbered chronologically within each 7½-minute quadrangle. Geologic and hydrologic records for them were obtained from various local concerns and agencies, chiefly County and State highway department.

Water wells drilled in Maryland since 1945 also have a number (not shown on this map) assigned by the Maryland Water Resources Administration. This number consists of a two-letter county prefix (for example, BA for Baltimore County) followed by a two-digit number indicating the State fiscal year in which the permit was issued (for example, -72 for the 1972 fiscal year). A four-digit chronologic sequence number follows the fiscal year designation. Thus, well BA-72-0010 is the tenth well permit issued for Baltimore County during the 1972 fiscal year.

○ 10 WATER WELL AND LOCATION NUMBER

○ 3 SPRING AND LOCATION NUMBER

● 7T BORE HOLE OR TEST HOLE AND NUMBER

SELECTED REFERENCES

Bennett, R. R. and Meyer, R. R., 1952, Geology and ground-water resources of the Baltimore area: Maryland Dept. of Geology, Mines and Water Resources[1] Bull. 4, 573 p.

Cleaves, E. T., Edwards, Jonathan, Jr., and Glaser, J. D. (compilers and editors), 1968, Geologic Map of Maryland: Maryland Geol. Survey, scale 1:250,000.

Dingman, R. J., and Ferguson, H. F., 1956, The ground-water resources of the Piedmont in The water resources of Baltimore and Harford Counties: Maryland Dept. of Geology, Mines and Water Resources[1] Bull. 17, p. 1-128.

Laughlin, C. P., 1966. Records of wells and springs in Baltimore County, Maryland: Maryland Geol. Survey Water Resources Basic Data Rept. 1, 403 p.

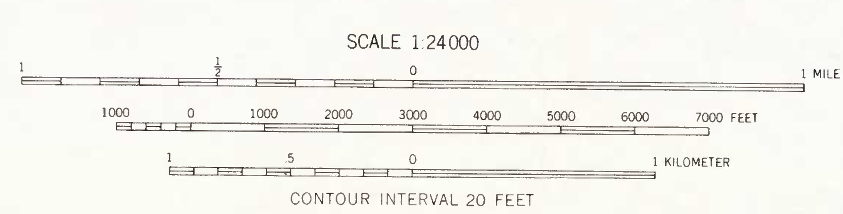
[1] Name of this agency changed to Maryland Geological Survey in 1964.

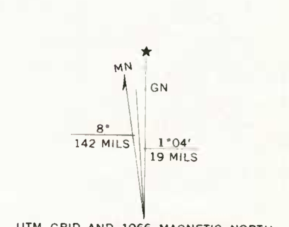
SUPPLEMENTAL RECORDS OF WELLS IN THE COCKEYSVILLE QUADRANGLE 1/

Well number	State permit number	Owner or name	Driller	Date completed	Altitude (feet)	Well type	Well depth (feet)	Well diam. (inches)	Casing length (feet)	Aquifer 2/	Water level (feet below land surf.): Static and date	Water level (feet below land surf.): Pumping and date	Yield (gal/min) and date	Specific capacity [(gal/min)/ft]	Remarks
BA-DC427	B66W-755	Happy Hollow Camp (Mrs. Whitehurst)	G. E. Harr Sons	6/22/66	535	drilled	176	6	-	1(g-s) Wlps	54.7 (6/22/65)	- -	3½	-	Domestic and day camp use
BA-DC428	B66W-17	Knutson Constr. Co.	do	11/22/65	505	do	160	6¼	26	1(g-s) Wlps	59.2 (11/24/65)	150 (6/22/65	6 (6/22/65)	0.07	Domestic use
BA-DC429	B66W-16	do	do	12/3/65	505	do	171	do	30	1(g-s) Wlps	57.5 (12/6/65)	160 (12/3/65)	12 (12/3/65)	.12	Domestic use; 4-hour test
BA-DC430	B66W-74	R. R. McKenzie	do	8/30/65	350	do	222	6	52	cld Cm	23 (8/30/65)	- -	9 (8/30/65)	-	Domestic use; 1-hour test
BA-DC431	B66W-136	Nathan Gerber	do	10/22/65	540	do	162	6¼	54	1(g-s-k) Wlps	31.1 (10/29/65)	- -	1½ (11/22/65)	-	Domestic use; 2-hour test
BA-DC432	B66W-275	Ensor Bldg. Co.	do	11/29/65	350	do	102	do	45	cld Cm	22.9 (12/6/65)	- -	10 (11/29/65)	-	Domestic use; Water at 80 ft.
BA-DC434	-	Maryvale School	Howard Dillon	1957	480	do	275	6	-	1(g-s) Wlps	11 (8/19/64)	275 (1957)	1½ (1957)	<.01	Well inadequate; standby use only
BA-DC435	B68W-133	Lloyd Smith	G. E. Harr Sons	11/-/67	540	do	340	6¼	24	lr Wlps	58 (11/-/67)	- -	2 (11/-/67)	-	Domestic use
BA-DC436	-	Koinonia Foundation	do	1902	420	do	150	do	-	1(g-s) Wlps	14.8 (5/22/70	- -	-	-	Oldest well on property
BA-DC437	285	do	do	1946	440	do	272	6	-	1(g-s) Wlps	30 (1946)	140 (1946)	30 (1946)	.3	Owner's well no. 2; 8-hour test
BA-DD294	B66W-107	Chapel Ridge Devel. Co.	do	8/-/65	605	do	289	6¼	35	1(g-s) Wlps	39.3 (10/19/65)	200 (10/19/65)	1½ (1965)	<.01	Lot 4, Block A; 8-hour test rept.
BA-DD295	-	Balto. County Dept. Public Works	Not known	1966	277	do	438	4	90	clm Cm	flowed	- -	-	-	Core hole at Texas landfill
BA-EC201	B68W-161	Dr. Harold Bryant	G. E. Harr Sons	-	380	do	125	6	42	sl p€bg	-35 (11/-/67)	- -	6	-	Domestic use
BA-ED83	B66W-206	Stewart McLean	do	11/17/65	275	do	142	6¼	22	cpl Cm	16 (11/17/65)	120 (11/17/65)	35 (11/-/65)	.3	Domestic use; 1-hour test
BA-ED84	B66W-37	L. W. Barroll	do	11/9/65	280	do	135	do	38	O bgb	28 (11/9/65)	63 (11/9/65)	7 (11/9/65)	.5	Domestic use; 4-hour test
BA-ED86	16399	Rockland Bleach & Dye Works Co.	Md. Drilling Co.	1/-/55	245	do	28	8-6	7	Qal Qdu	flowed	4.5 (1/-/55)	325	72	6-inch diam. screen 5 to 27 ft.
BA-ED87	16398	do	do	1/-/55	245	do	38	do	9	Qal Qdu	do	6 (1/-/55)	750	125	6-inch diam. screen 9 to 38 ft.
BA-ED88	16657	do	do	1/-/55	245	do	38	do	11	Qal(?) Qdu(?)	-	3 (1/-/55)	75	-	6-inch diam. screen 11 to 31 ft.
BA-ED89	21429	do	do	12/-/55	245	do	38	8	8	Qal Qdu	flowed	12 (12/-/55)	300	-	Slotted casing 8 to 35 ft.
BA-ED90	21430	do	do	4/-/56	245	do	42	do	7	Qal Qdu	do	10 (4/-/56)	300	-	Slotted casing 7 to 39 ft.

1/ These records include only wells inventoried subsequent to the compilation of well records in Maryland Geological Survey Basic Data Report No. 1 (Laughlin, 1966).

2/ Aquifers designated in accordance with the symbols used in the Geologic Map included with this Atlas and with the symbols used on the Geologic Map of Maryland (Cleaves, and others, 1968), where: Cm is Cockeysville Marble; p€bg is Baltimore Gneiss; bgb is Baltimore Gabbro Complex; Wlps is Wissahickon Formation (lower pelitic schist); and Qdu is Quaternary deposits, undivided.

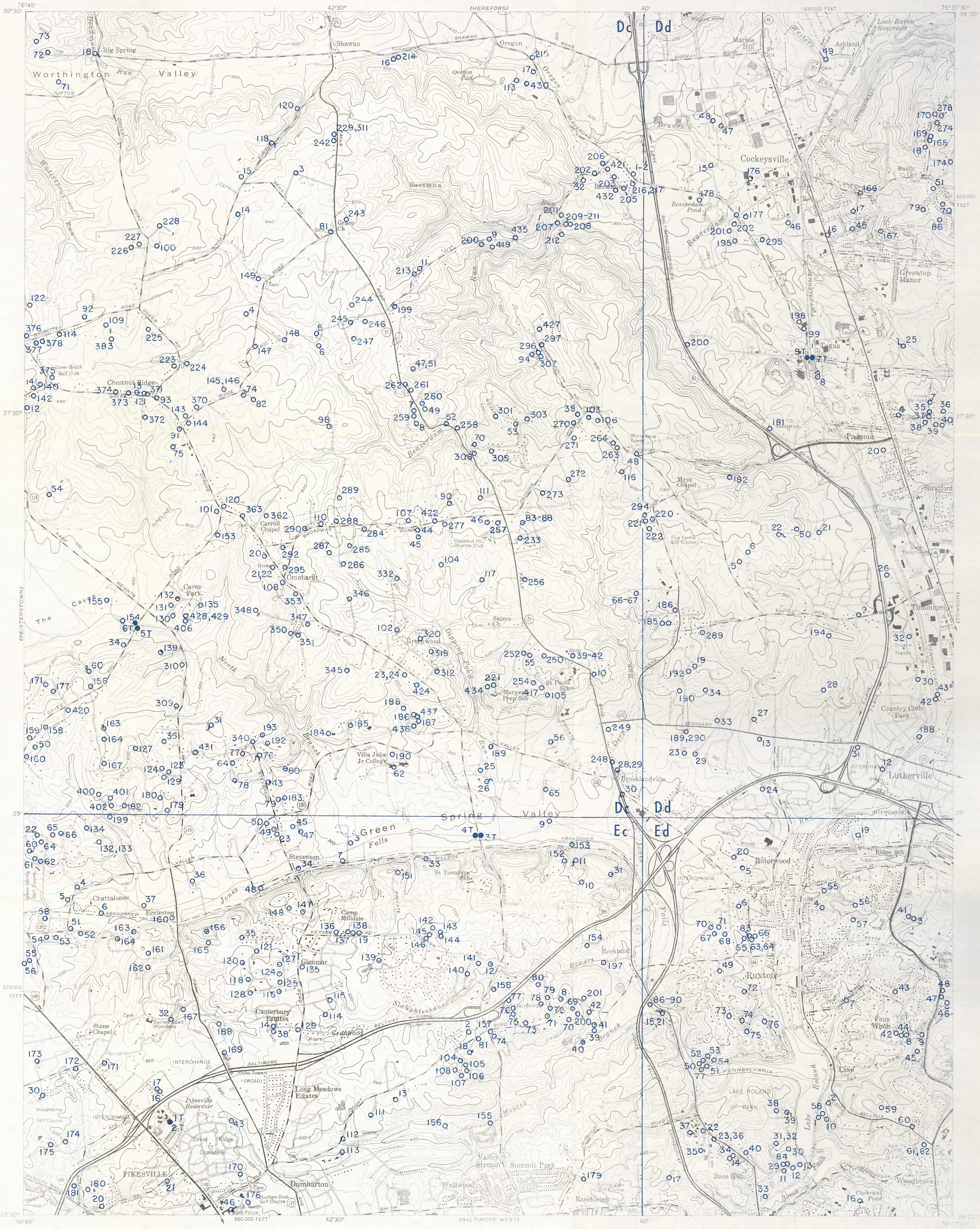




STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

Prepared in cooperation with the U. S. Geological Survey, Water Resources Division

Copies of Atlas available from
Maryland Geological Survey
Johns Hopkins University
Baltimore, Maryland 21218



Base map from U.S. Geological Survey, 1957 (photorevised 1966) Cockeysville Quadrangle 7½ Minute Series

Williams & Heintz Map Corporation, Washington, D. C. 20027

COCKEYSVILLE QUADRANGLE: GEOLOGY, HYDROLOGY AND MINERAL RESOURCES

MAP 5. LOCATION OF WELLS, SPRINGS AND TEST HOLES

By
Edmond G. Otton

1975

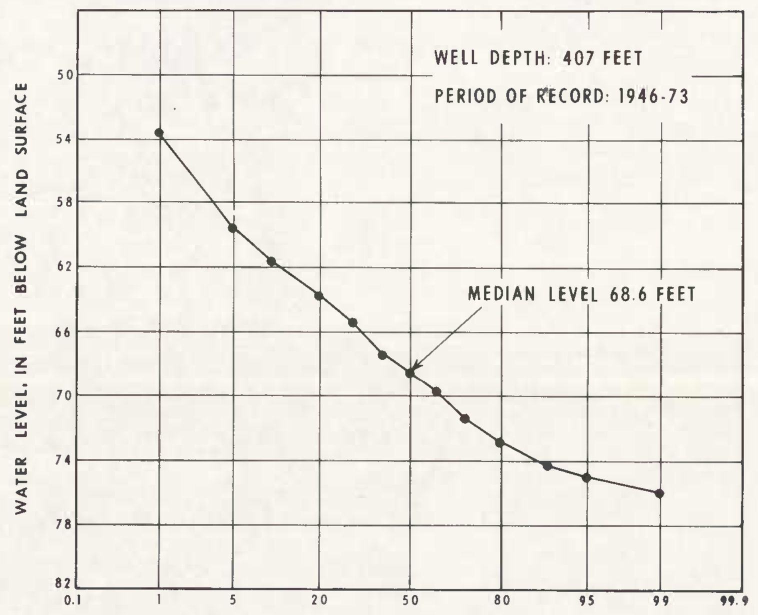
EXPLANATION

This map shows the depth to the top of the permanent zone of saturation (water table), as indicated by well and spring records. Locally, however, temporary or so-called perched zones of saturation may occur above the levels indicated on the map.

Ground-water levels, as measured in wells, fluctuate both seasonally and over longer periods in response to changes in frequency and amounts of infiltrating precipitation. Ground-water levels also fluctuate in response to withdrawals from wells. However, in the Cockeysville quadrangle, pumping by domestic wells probably does not significantly affect ground-water levels, except locally. Some lowering of ground-water levels has occurred in the vicinity of a large quarry at Texas, Md., due to de-watering for quarry operations.

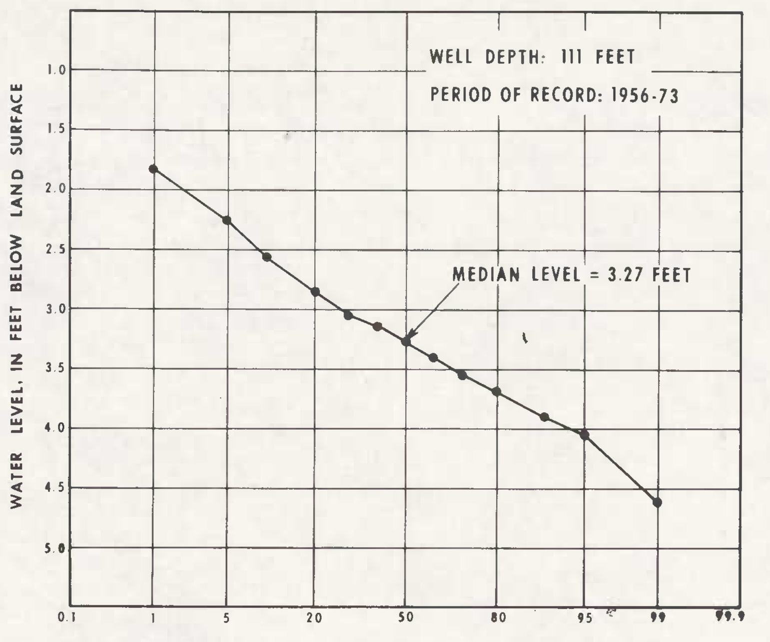
Generally, ground-water levels are lowest in the late summer and early fall and highest in the late winter and early spring. The greatest fluctuation in ground-water levels occurs beneath hills and uplands and the smallest in valleys and swales.

The magnitude of possible fluctuations in ground-water levels are shown by the record of observation well CL-BF 1 at Hampstead, Md., a few miles west of the Cockeysville quadrangle. During the 28-year period, 1946-73, the non-pumping water level in this well fluctuated throughout a range of 23.9 feet. The well is situated on a hilltop and yields water from schistose rocks in the Wissahickon Group. The graph below is a stage-duration analysis of 280 water-level measurements over the period of record.



PERCENTAGE OF TIME WATER LEVEL IS ABOVE A GIVEN STAGE

The record of observation well BA-EC 43 in the Druid Ridge Cemetery near Pikesville shows that significantly smaller fluctuations in ground-water levels occur in valleys and lowlands. During the 18-year period 1956-73, the non-pumping water level in this well fluctuated throughout a range of only 3.4 feet. The well is situated in a small valley and penetrates the Baltimore Gneiss of Precambrian age. The graph below is a stage-duration analysis of approximately 200 water-level measurements during the period of record.



PERCENTAGE OF TIME WATER LEVEL IS ABOVE A GIVEN STAGE

The effect of pumping on nearby ground-water levels in the Piedmont rocks is indicated by the 15-year record of water levels in observation well BA-CD 26 near Sparks, Md., 1.7 miles north of the Cockeysville quadrangle. Non-pumping water levels in this well during 1958-73 fluctuated throughout a range of 48 feet. Well BA-CD 26 is 250 feet deep, yields water from the Baltimore Gneiss, and is in the vicinity of several supply wells for a small industrial plant.

APPROXIMATE DEPTH TO WATER, IN FEET BELOW LAND SURFACE

0 - 10 | 10 - 35 | 35 - 75+

Depth to water greater than normal because of localized ground-water pumping from a large quarry.

SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

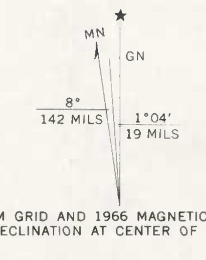
Base map from U.S. Geological Survey, 1957 (photorevised 1966) Cockeysville Quadrangle 7½ Minute Series

Williams & Heintz Map Corporation, Washington, D. C. 20027

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

Prepared in cooperation with the U. S. Geological Survey, Water Resources Division

Copies of Atlas available from
Maryland Geological Survey
Johns Hopkins University
Baltimore, Maryland 21218



UTM GRID AND 1966 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

COCKEYSVILLE QUADRANGLE: GEOLOGY, HYDROLOGY AND MINERAL RESOURCES

MAP 6. DEPTH TO THE WATER TABLE

By

Edmond G. Otton
1975

EXPLANATION

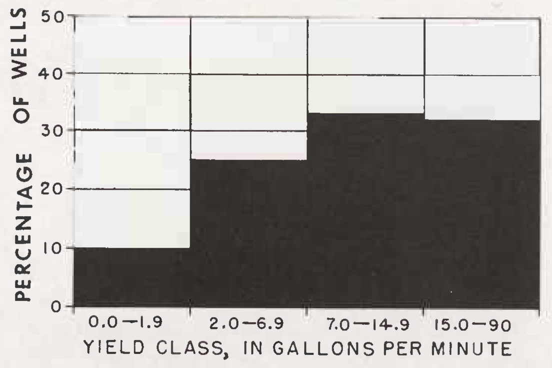
INTRODUCTION

The rocks of the Cockeysville quadrangle are subdivided into several geohydrologic units according to their water-bearing characteristics. Although the units are part of an areawide classification scheme, the statistics given for each unit are based only on data from the Cockeysville and adjacent quadrangles. Thus, Geohydrologic Unit I, underlain by Coastal Plain sediments, is absent from the Cockeysville quadrangle, but is present in quadrangles to the south and east.

2

GEOHYDROLOGIC UNIT 2: Area is underlain by carbonate crystalline rocks, chiefly metalimestone and dolostone. These rocks weather irregularly from a clean white to yellow sand (derived from dolostone) to a brown to red-brown clayey loam. In some places, depths of weathering may be in excess of 100 feet but average about 40 feet. Solutional weathering by circulating ground water locally has developed a modified karst topography, but sinkholes and solutional channels are not major features in this quadrangle. This unit includes areas mapped as the Cockeysville Marble on the geologic map of this Atlas.

WELL YIELDS AND DEPTHS: These rocks are among the most productive aquifers in the Maryland Piedmont. Reported yields of 76 wells in the Cockeysville quadrangle range from 0 to 90 gal/min. The mean yield is 14 gal/min. About 10 percent of the wells yield less than 2 gal/min, or at rates considered inadequate for domestic use by the Maryland Water Resources Administration.[1] About 24 percent of the wells yield 15 gal/min or more. The following graph shows the percentage of wells in designated yield classes, based on the records of 76 wells. Depths of these wells range from 22 to 1,800 feet and average 214 feet.

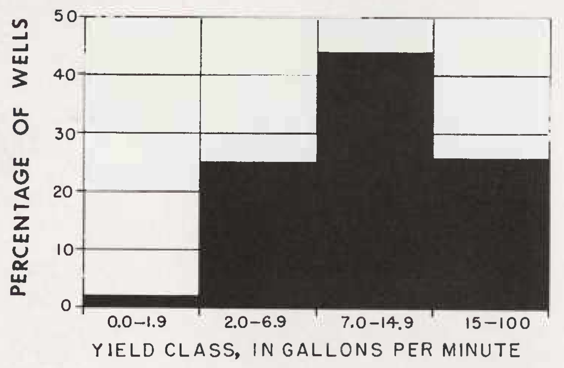


WELL SPECIFIC CAPACITIES: Reported specific capacities[2] of 54 wells range from 0.0 to 3.5 (gal/min)/ft of drawdown and average about 0.5 (gal/min)/ft.

3

GEOHYDROLOGIC UNIT 3: Area underlain by varied gneissic rocks, including augen gneiss and some massive gneiss that weathers to an orange color. This unit also includes ridge-forming rocks composed of impure quartzite. Depths of weathering range from 0 to 114 feet and average 38 feet. The unit includes areas shown as Baltimore Gneiss and Setters Formation on the Geologic Map of this Atlas.

WELL YIELDS AND DEPTHS: These rocks are moderately productive aquifers. The yields of 143 wells in this and adjacent quadrangles range from 0 to 100 gal/min and average 12 gal/min. Only 2 percent of the wells yield less that 2 gal/min; 26 percent of the wells yield 15 gal/min or more. The graph below shows the percentage of wells in designated yield classes, based on records of 143 wells. Depths of these wells range from 37 to 470 feet and average 139 feet.

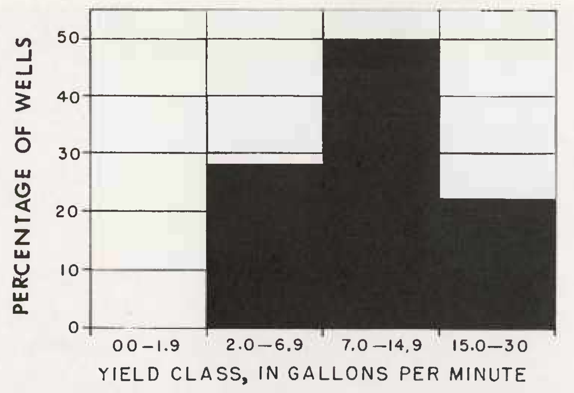


WELL SPECIFIC CAPACITIES: Specific capacities of 121 wells range from 0.0 to 2.7 (gal/min)/ft of drawdown and average 0.4 (gal/min)/ft.

4 A

GEOHYDROLOGIC UNIT 4 A: Area underlain by amphibolite and serpentinite on the Geologic Map of this Atlas. The topography developed on the amphibolite and serpentinite is somewhat subdued compared with that on other rock types in the area. The soils are typically a reddish clay loam grading downward to red and gray clay. Depths of weathering range from 0 to a few tens of feet.

WELL YIELDS AND DEPTHS: This unit is capable of yielding only moderate supplies of water to wells. Reported yields of 40 wells in the Cockeysville and adjacent quadrangles to the south and west range from 2 to 30 gal/min and average about 10 gal/min. None of the wells yield less than 2 gal/min; 22 percent of the wells yield 15 to 30 gal/min. The graph below shows the percentage of wells in designated yield classes, based on records of 40 wells. Depths of 72 wells range from 31 to 199 feet and average 83 feet.

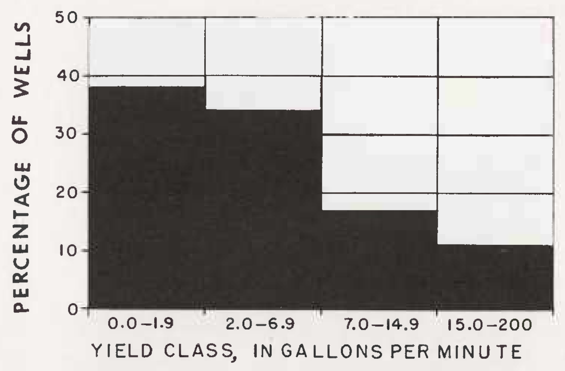


WELL SPECIFIC CAPACITIES: Reported specific capacities of 40 wells range from 0.0 to 3.0 (gal/min)/ft of drawdown and average 0.6 (gal/min)/ft. Yields and specific capacities of wells completed in the gabbroic rocks in the Cockeysville and Baltimore West quadrangles appear to be somewhat higher than for wells in similar rocks in the White Marsh quadrangle, 10-15 miles to the east. The mean specific capacity of gabbro wells in the Cockeysville area is 0.6 (gal/min)/ft versus a value of 0.4 (gal/min)/ft in the White Marsh area. The reason for this is unknown but may be due to more intensive fracturing of the rocks plus greater depths of weathering in the Cockeysville area. Hence, this hydrologic unit has been designated 4-A in the Cockeysville quadrangle.

5

GEOHYDROLOGIC UNIT 5: Area underlain by schistose and quartzose rocks characterized by an abundance of micaceous minerals and kyanite, staurolite, and garnet. Unit typically has rolling to locally rugged topography having elongated ridges separated by steep-sided valleys. Thickness of weathered zone variable, but averages about 50 feet except along stream valleys, where it is much thinner. This unit includes the Wissahickon Group of the Geologic Map of this Atlas.

WELL YIELDS AND DEPTHS: In the Cockeysville quadrangle, Unit 5 is a poor aquifer capable in most localities of yielding only modest supplies of water. The reported yields of 80 wells range from 0 to 200 gal/min and average 8 gal/min. About 38 percent of the wells yield less than 2 gal/min; only 11 percent of the wells yield 15 to 200 gal/min. The few highly productive wells are in stream valleys where quartzose rocks are intensely fractured and jointed. The graph shown below indicates the percentage of wells in designated yield classes. The depths of 75 wells range from 54 to 735 feet and average 199 feet.



WELL SPECIFIC CAPACITIES: Reported specific capacities of 41 wells range from 0.0 to 4.4 (gal/min)/ft of drawdown and average slightly less than 0.2 (gal/min)/ft.

SUMMARY OF GEOHYDROLOGY

In summary, the yields of 339 wells in the Cockeysville quadrangle and vicinity range from 0 to 200 gal/min and average 11 gal/min. About 12 percent of the total wells for which adequate records are available yield less than 2 gal/min, or at rates considered inadequate for domestic supplies. Depths of 366 wells range from 22 to 1,800 feet and average 156 feet. Specific capacities of 256 wells range from 0.0 to 0.4 (gal/min)/ft of drawdown and average 0.4 (gal/min)/ft.

Although the above information on well yields and specific capacities is a synthesis of information from 339 wells, the data have an inherent bias because more than 90 percent of the wells are for domestic use. These wells are located mainly on uplands and hilltops, where conditions are less favorable for more productive wells than they are in valleys and lowlands. Furthermore, not all domestic wells are tested for their maximum capacity. Studies show that wells in valleys have yields two to three times greater than wells on hilltops (Dingman and Ferguson, 1956, and Nutter and Otton, 1969). Therefore, yields of most domestic wells tend to be suboptimal. Nutter has indicated (1974, p. 18) that rock wells located on the basis of a hydrogeologic site investigation may, on the average, yield from 40 to 100 gal/min or more.

SELECTED REFERENCES

Cleaves, E. T., 1968, Piedmont and Coastal Plain geology along the Susquehanna aqueduct-Baltimore to Aberdeen, Maryland: Maryland Geol. Survey Rept. Inv. 8, 45 p.

Dingman, R. J., and Ferguson, H. F., 1956, The ground-water resources of the Piedmont in The water resources of Baltimore and Harford Counties: Maryland Dept. of Geology, Mines and Water Resources[3] Bull. 17, p. 1-128.

Ferris, J. G., Knowles, B. B. Brown, R. H., and Stallman, R. W., 1962, Theory of aquifer tests: U.S. Geol. Survey Water-Supply Paper 1536-E, 173 p.

Nutter, L. J., 1974, Well yields in the bedrock aquifers of Maryland: Maryland Geol. Survey Inf. Circ. 16, 24 p.

Nutter, L. J., and Otton, E. G., 1969, Ground-water occurrence in the Maryland Piedmont: Maryland Geol. Survey Rept. Inv. 10, 56 p.

Otton, E. G., Martin, R. O. R. and Durum, W. H., 1964, Water resources of the Baltimore area, Maryland: U.S. Geol. Survey Water-Supply Paper 1499-F, 105 p.

1 The Maryland Water Resources Administration defines an adequate domestic well as one that will yield 2 gal/min or more during a 2-hour period. The well water-supply systems shall be capable of producing this quantity three times during any one 24-hour period.

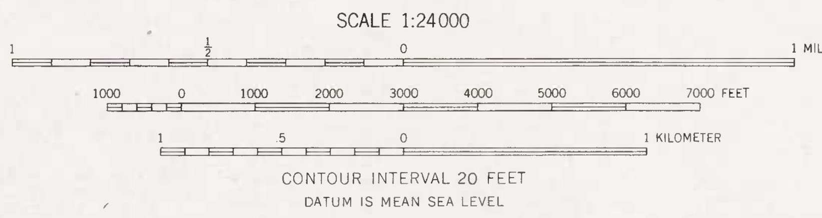
2 Specific capacity of a well is the yield per foot of drawdown of the water level in the well. No time period is, however, specified for the measurement of this parameter, which is commonly expressed in gallons per minute per foot of drawdown. For many domestic wells the period of measurement ranges from 2 to 6 hours.

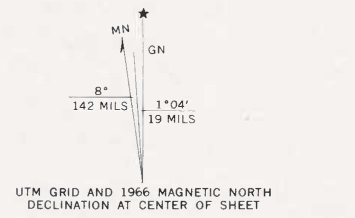
3 The name of this agency was changed to the Maryland Geological Survey in June 1964.

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

Prepared in cooperation with the U. S. Geological Survey, Water Resources Division

Copies of Atlas available from
Maryland Geological Survey
Johns Hopkins University
Baltimore, Maryland 21218





Base map from U.S. Geological Survey, 1957 (photorevised 1966) Cockeysville Quadrangle 7½ Minute Series

Williams & Heintz Map Corporation, Washington, D. C. 20027

COCKEYSVILLE QUADRANGLE: GEOLOGY, HYDROLOGY AND MINERAL RESOURCES

MAP 7. AVAILABILITY OF GROUND WATER

By
Edmond G. Otton

1975

EXPLANATION

EVALUATION OF UNITS

The four areas, or units, shown on this map differ widely in their degree of limitation for domestic liquid-waste disposal systems because of differences in soil and subsoil infiltration characteristics, land slope, depth to the water table, flood hazard, and the existence of a thin or rocky soil mantle over bedrock at various places.

The following graph shows the range in constraints of the various units for use as a disposal medium:

MAXIMUM CONSTRAINTS	MODERATE TO VARIABLE CONSTRAINTS		MINIMUM CONSTRAINTS
I	II	III	IV

FACTORS GOVERNING THE EVALUATION

1. Soil and subsoil infiltration rates were determined chiefly on the basis of several hundred percolation tests[1] conducted by sanitarians of Baltimore County under standardized procedures established by the Maryland Department of Health.

2. Land slopes were obtained from a machine-generated slope map, prepared by the U.S. Geological Survey. Maryland Department of Health regulations (July 1964, Section 1, definitions, part 1.9) do not permit, as of 1974, the installation of underground domestic sewage disposal systems where the slope of the land surface is in excess of 25 percent. Steep slopes are considered to be a major contributing cause of failure of underground disposal systems (U.S. Public Health Service, 1967, p. 18 and U.S. Department of Agriculture, Soil Conservation Service, 1971, p. 8).

3. The 10-foot minimum depth to the water table used as a constraint in this report is the sum of three component factors. These are: (a) the recommended depth of drain tile fields is at least 3 feet below the land surface (U.S. Department of Agriculture, Soil Conservation Service, 1971, p. 3); (b) a minimum depth of 4 feet between the base of the tile field (absorption trench) and the underlying water table is recommended (U.S. Public Health Service, 1967, p. 11); and (c) a 3-foot additional depth is suggested to allow for seasonal variations in position of the water table, which commonly fluctuates through at least a 3-foot range in Piedmont valleys.

4. Most valleys in the Cockeysville quadrangle are subject to periodic flooding. Floods would cause uncontrollable dispersal of sewage effluent and possible physical damage to the disposal system.

5. Where bedrock crops out or occurs near the land surface, the construction of underground disposal systems is not feasible. Hence, the existence of rock is an obvious terrane constraint.

[1] The standard percolation test conducted in the Maryland Piedmont counties (1975) is performed as follows: a 2- to 3-foot wide pit is dug to the depth to be tested and a 1-foot square hole is hand-excavated on the floor of the pit. The 1-foot hole is filled with water, and the time required for the water to drop the second inch of a 2-inch decline is measured. To be rated as "passing" or successful, the rate of drop of the water level must be between 1 and 30 minutes per inch. Declines of the water level at rates too fast or too slow are the basis for rejection of the unit of land sampled by the test. Also, the presence of shallow ground water or rock ledges is an additional basis for rejection of the test site. Where clayey (impervious) materials are encountered in a test pit, the actual test may not be performed, based on the judgment of the sanitarian conducting the test.

MAP UNITS

I — UNIT I. Includes low-lying valley-bottom areas subject to periodic flooding, areas where the depth to the permanent water table ranges from 0-10 feet (Map 6), and areas where the slope of the land surface exceeds 25 percent. Unit I is underlain by stream alluvium, colluvium, and rocky land consisting of the various Piedmont crystalline rock units present in the quadrangle. The depth of overburden on the steep slopes generally ranges from 0 to 5 feet.

The terrain in Unit I is characterized by steep-sided valley slopes, commonly having exposed rocks, and by valley bottoms underlain by a shallow water table and subject to the hazard of periodic flooding. Very few percolation tests have been made in Unit I, but, in many valley-bottom sites, a shallow water table and tight soils would preclude successful (passing) test results.

II — UNIT II. Includes areas underlain by serpentinite and amphibolite which characteristically develop a relatively impervious clayey soil and subsoil (areas shown as Baltimore Mafic Complex on the accompanying geologic map). Generally, the top of the permanent zone of saturation, as observed in wells, lies at depths greater than 10 feet (Map 6), but shallow, perched zones of saturation, may occur locally.

Localities in this unit commonly have poorly permeable soils and and subsoils. Percolation tests conducted by sanitarians of Baltimore County show about a 60 percent failure rate. The depths of 12 successful tests range from 3 to 13 feet and average about 7 feet below the land surface. The percolation rates range from 6 to 30 minutes per inch and average 13 minutes per inch. Some domestic disposal systems installed in Unit II, prior to the use of standard soil testing procedures, have failed. However, much of the area of Unit II is now (1974) served by municipal sewers.

III — UNIT III. Includes areas underlain chiefly by crystalline metalimestone and dolostone underlying the Green Spring and Worthington Valleys and the Cockeysville-Timonium areas (shown as Cockeysville Marble on the accompanying geologic map). The subsoil in this unit ranges from a brown to tan, impervious clayey loam to a whitish-yellow, permeable, dolomitic sand. In places, the weathered zone may be several tens of feet thick, while bedrock may crop out nearby. Depth to the water table commonly ranges from 10 to 35 feet (Map 6).

Within this map unit, subsoils on adjoining lots may exhibit widely different infiltration characteristics. Percolation tests by County sanitarians show a failure rate of 48 percent, based on 91 tests. The depths of 48 successful tests range from 3 to 22 feet and average about 9 feet. The measured percolation rates of these tests range from 1.5 to 30 minutes per inch and average about 11 minutes. The average value is of limited significance, however, as the test data show a bimodal distribution of values. In general, extremely diverse conditions exist in this unit with regard to underground waste disposal.

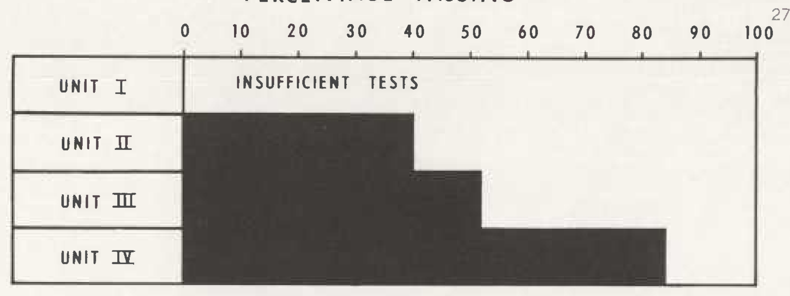
IV — UNIT IV. Includes areas underlain by schistose, quartzose, and gneissic crystalline rocks having moderately permeable subsoils throughout most of the area (shown on the geologic map as the Baltimore Gneiss, Slaughterhouse Gneiss, the Setters Formation, and the Wissahickon Group. The subsoil throughout much of the unit consists of brown to tan or reddish, micaceous saprolite characterized by a less permeable "massive" zone in the upper 3 to 4 feet, commonly underlain by a "structured" zone from a depth of 3-4 feet down to the top of fresh or unaltered rock. Most underground disposal systems in Baltimore County are in the "structured" zone. Throughout most of the area the depth to the top of the permanent water table is 10 to 35+ feet (Map 6).

Percolation tests in Unit IV show a failure rate of only 16 percent, based on 244 tests. The depths of 70 successful tests range from 3 to 16 feet below the land surface and average 8 feet. The measured percolation rates of these tests range from 1.2 to 28 minutes per inch and and average 7 minutes per inch. Although the soil and subsoil appear to be sufficiently permeable to permit the installation of underground disposal systems in most localities in Unit IV, pollution of nearby wells and springs may occur in the vicinity of disposal systems where such wells or springs are downslope from or too near the drain field or disposal pit.

Areas where bedrock is exposed. Underground disposal systems in these localities cannot comply with current (1975) regulations.

SUMMARY

The interpretations represented by the units shown on this map are based on a synthesis of geologic mapping by the Maryland Geological Survey, of published soils data (1963), and of more than 340 percolation tests conducted by the Baltimore County Health Department, in addition to geohydrologic data from the large number of well and spring records. Although the use of standarized percolation tests is far from an ideal method to determine the suitability of a tract of land for use for underground disposal purposes, it is the most practical method that has been developed to date (1974). A statistical analysis of percolation test data does reveal the inherent controls on the uses of land exerted by geohydrologic factors. The following graph summarizes the results of these tests for the waste-disposal units:



RESULTS OF PERCOLATION TESTS

Information from the Baltimore County Health Department indicates that about 29,000 underground sewage disposal systems were in use in the entire County during 1973, of which 80 percent (23,000) were "dry wells" or disposal pits (William Greenwalt, oral commu., 1973). Probably less than 15 percent of the underground disposal systems in Baltimore County are in the Cockeysville quadrangle.

The terrain classification given here is not intended to supplant detailed site investigations by specialists concerning terrain suitability for underground disposal of domestic liquid effluent. The map is primarily for land-use and planning purposes.

REFERENCES

Maryland Geological Survey, 1925, Map of Baltimore County and Baltimore City showing the geological formations (1 sheet).

University of Maryland, Maryland State Roads Commission, U.S. Bureau of Public Roads, 1963, Engineering soil map of Baltimore County (1 sheet).

U.S. Department of Agriculture, Soil Conservation Service, 1971, Soils and septic tanks: 12 p.

U.S. Public Health Service, 1967 rev., Manual of septic-tank practice: 92 p.

Base map from U.S. Geological Survey, 1957 (photorevised 1966) Cockeysville Quadrangle 7½ Minute Series

Williams & Heintz Map Corporation, Washington, D.C. 20027

SCALE 1:24000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET

DATUM IS MEAN SEA LEVEL

MN GN 8° 142 MILS 1°04′ 19 MILS

UTM GRID AND 1966 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

Prepared in cooperation with the U. S. Geological Survey, Water Resources Division

Copies of Atlas available from
Maryland Geological Survey
Johns Hopkins University
Baltimore, Maryland 21218

COCKEYSVILLE QUADRANGLE: GEOLOGY, HYDROLOGY AND MINERAL RESOURCES

MAP 8. GEOHYDROLOGIC CONDITIONS PERTAINING TO DOMESTIC UNDERGROUND LIQUID-WASTE DISPOSAL

By
Edmond G. Otton
1975

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

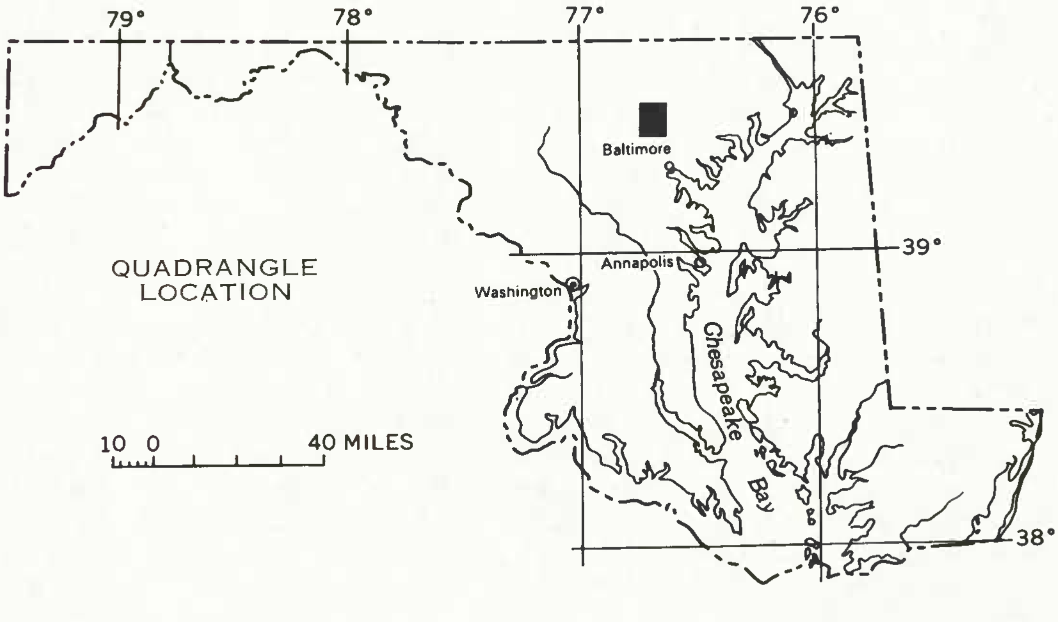
QUADRANGLE ATLAS NO. 3

COCKEYSVILLE QUADRANGLE: GEOLOGY, HYDROLOGY AND MINERAL RESOURCES

By
Edmond G. Otton, Emery T. Cleaves, William P. Crowley, Karen R. Kuff
and Juergen Reinhardt

INTRODUCTION

This folio describes the geology, hydrology, and mineral resources of a 7½-minute topographic quadrangle in north-central Maryland. It is intended for county, State, and Federal officials as well as engineers, planners, developers, industrialists, and the general public involved in environmental matters such as water supply, waste disposal, and land-use planning. The Cockeysville quadrangle covers an area of 57.3 square miles and lies entirely within Baltimore County. As is true throughout all of Baltimore County, no incorporated towns are in the quadrangle, but the communities of Cockeysville, Ruxton, Pikesville, and Lutherville lie wholly or partly within it. The quadrangle lies on the suburban fringe of Baltimore City, and its southern limit is 0.2 mile north of the city line. The area is served by three major highways, I-695, I-83, and U.S. Route 140. The Harrisburg branch of the Penn-Central railroad traverses the entire length of the quadrangle.



CLIMATE

The Cockeysville quadrangle is in the north-central climatic division of Maryland, where the average precipitation is 44 inches per year (U.S. Department of Commerce, 1972). The annual precipitation in this division ranges from 24 to nearly 60 inches. The wettest year during 1929-74 was in 1972, when the annual precipitation of 60 inches exceeded the mean by 16 inches. The precipitation is evenly distributed throughout the year, seldom exceeding 6 inches in any one month. February is the driest month, having an average of 2.75 inches, and August is the wettest, having an average of 4.60 inches. The mean annual temperature is 54° F (12° C); January is the coldest month and July is the warmest.

DRAINAGE AND RELIEF

The quadrangle is drained by Jones Falls, Gwynns Falls, Beaverdam Run, Western Run, and their tributaries, all of which are part of the Chesapeake Bay drainage system. The area is hilly to undulating and gently sloping to flat along a few major valleys, such as the Green Spring and Worthington Valleys. The highest point in the quadrangle is 720 feet above sea level in the northwest corner near Baublitz Road and Green Spring Avenue. The lowest point is 200 feet above sea level along the valley of Jones Falls in the southeast corner of the quadrangle. Thus, the maximum relief is about 520 feet. A few areas of rugged, steep terrain occur in the valleys of Baisman Run, Western Run, and Beaverdam Run.

GEOLOGY

The Cockeysville quadrangle lies entirely within the Piedmont Physiographic Province. Its oldest rocks (Baltimore and Slaughterhouse Gneisses) constitute the basement surface of the continental shelf which bordered the Atlantic margin of the North American continent in Cambro-Ordovician times and upon which were deposited sandstone and shale (Setters Formation) and limestone and dolostone (Cockeysville Marble). Subsequent closure of the adjacent ocean led to an influx of shale (Loch Raven Schist) and interbedded shale and sandstone together with basaltic volcanic material (Oella Formation) accompanied by thrust slices of mafic and ultramafic rock (Baltimore Mafic Complex and the serpentinite at Bare Hills). The entire rock pile was then deformed and metamorphosed and intruded by pegmatite. The earliest deformation resulted from plastic flow and is expressed by such folded structures as the Towson and Chattolanee domes. Later brittle deformation led to the development of zones of rupture and silification such as the Ruxton fault. Metamorphism brought about the reconstitution of such rocks as sandstone and shale, for example, to quartzite and schist.

The crystalline rocks have been undergoing chemical weathering and fluvial erosion for at least 130 million years. The present landscape with its hills, valleys and streams, has been formed by weathering processes during the last 10 to 15 million years. Throughout the quadrangle the crystalline rocks are mantled by residuum (saprolite) that varies in thickness depending upon the type of rock and topographic position. In places the saprolite is thin or absent (steep hillslopes, for example); in other places the saprolite is 50 feet or more thick (broad upland areas). On the Cockeysville Marble, rock is exposed at the surface in places, and in other areas the residuum may exceed 100 feet in thickness.

HYDROLOGY

Ground water occurs in the crystalline rocks of the Piedmont region--in the pores and voids in the weathered rock (saprolite) and in the fractures and joints in the unweathered or "fresh" rock. The top of the zone of saturation in these rocks is the water table, or the potentiometric surface. Where the rocks in the saturated zone are capable of yielding water to wells and springs, they are called aquifers. Some of the Piedmont rocks, such as the gneisses and marbles, are somewhat better aquifers than other rocks, such as schists or phyllites. The yield of individual wells depends on such factors as topographic position of the well and the nature and thickness of the weathered zone, as well as the extent and degree of fracturing of the rocks at the well site.

The source of all ground water in the Piedmont is local precipitation. Of the 44 inches of precipitation, hydrologic studies show that 8 to 10 inches (18 to 23 percent) becomes ground-water recharge. The ground-water reservoir functions as a storage cell in the natural hydrologic system, accumulating water during wet periods and releasing it during wet and dry periods. Over a long period of time, discharge from the ground-water reservoir must equal recharge, or replenishment, to it. Ground-water discharge supplies streamflow in dry weather. The role of the ground-water reservoirs in the hydrologic system is shown by the hydrologic budget equation for the Maryland Piedmont region, which follows:

$$P = R + ET \pm GW_s$$

$$44 = 18 + 26 \pm 0 \text{ (inches)}$$

where: P = precipitation
R = runoff (or streamflow)
ET = evapotranspiration
GW_s = ground-water storage

MINERAL RESOURCES

Throughout the years, this area has been the source of many types of mineral commodities. Included among these are; the United States' first chromite mine, the State's largest copper mine, numerous iron ore operations, flagstone, and the marble used to build the Washington Monument in Washington, D.C. Today, little remains of what was once an influential factor in the growth of Baltimore. The current mineral industry within the quadrangle involves the extraction of Cockeysville Marble, primarily for crushed stone. There are other potential mineral resources that could be exploited to satisfy future needs, including Slaughterhouse Gneiss and Setters Formation.

MAPS INCLUDED IN THE ATLAS

The information compiled during this investigation is in the form of eight numbered maps. Maps 1 through 4 were prepared by Maryland Geological Survey geologists and Maps 5 through 8 by E. G. Otton, geohydrologist, Water Resources Division, U.S. Geological Survey. The standard topographic quadrangle map of 1957 (photorevised in 1966) is the base upon which data and interpretations are shown.

Map 1. Geologic Map, by William P. Crowley, Juergen Reinhardt and Emery T. Cleaves

Map 2. Estimated Thickness of Overburden, by Emery T. Cleaves

Map 3. Geologic Factors Affecting Land Modification, by Emery T. Cleaves

Map 4. Mineral Resources and Mined Inventory, by Karen R. Kuff

Map 5. Location of Wells, Springs, and Test Holes, by Edmond G. Otton

Map 6. Depth to the Water Table, by Edmond G. Otton

Map 7. Availability of Ground Water, by Edmond G. Otton

Map 8. Geohydrologic Conditions Pertaining to Domestic Underground Liquid-Waste Disposal, by Edmond G. Otton

LIMITATIONS OF MAPS

All of the maps of this Atlas represent some degree of judgment and interpretation of available data. The boundaries depicted in all the maps are not to be construed as being final, nor is the information shown intended to supplant a detailed site evaluation by a specialist in these fields.

CONVERSION FACTORS

In this Atlas, figures for measurements are given in English units with the exception of the Geologic Map which is in metric units. The following table contains the factors for converting these English units to metric (System International or SI) units:

ENGLISH UNIT	SYMBOL	EQUIVALENT (Multiply by)	METRIC UNIT (unit)
Inches		25.4	Millimetres
Feet	(ft)	0.3048	Metres
Miles		1.609	Kilometres
Square Miles		2.590	Square kilometres
U.S. gallons		3.785	Litres
U.S. gallons per minute	(gal/min)	0.06309	Litres per second
U.S. gallons per minute per foot	[(gal/min)/ft]	0.207	Litres per second per metre

SELECTED REFERENCES

Choquette, P. W., 1960, Petrology and structure of the Cockeysville Formation (Pre-Silurian) near Balitmore, Maryland: Geol. Soc. America Bull. v. 71, no. 7, p. 1027-1052

Cleaves, E. T., 1968, Piedmont and Coastal Plain geology along the Susquehanna aqueduct, Baltimore to Aberdeen, Maryland: Maryland Geol. Survey Rept. Inv. 8, 45 p.

Knopf, E. B. and A. I. Jonas, 1929, The Geology of the Crystalline Rocks of Baltimore County: in; Baltimore County, Md. Geol. Survey, p. 97-218

Maryland Geological Survey, 1925, Map of Baltimore County and Baltimore City showing the geological formations (1 sheet).

Mathews, E. B., 1898, An account of the character and distribution of Maryland building stones, together with a history of the quarrying industry: Md. Geol. Survey, v. 2, pt. 2, p. 125-241.

Mathews, E. B., and Watson, E. H., 1929, The mineral resources of Baltimore County: in; Baltimore County, Md. Geol. Survey, p. 219-288

Nutter, L. J., 1974, Well yields in the bedrock aquifers of Maryland: Maryland Geol. Survey Inf. Circ. 16, 24 p.

Nutter, L. J., and Otton, E. G., 1969, Ground-water occurrence in the Maryland Piedmont: Maryland Geol. Survey Rept. Inv. 10, 56 p.

O'Bryan, Deric, and McAvoy, Russell L., 1966, Gunpowder Falls, Maryland, Uses of a water resource today and tomorrow: U.S. Geol. Survey Water-Supply Paper 1815, 90 p.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1972, Climatological Data, Ann. Summary: v. 76, no. 13.

QUADRANGLE ATLAS NO. 3

COCKEYSVILLE QUADRANGLE: GEOLOGY, HYDROLOGY AND MINERAL RESOURCES

By

Edmond G. Otton, Emery T. Cleaves, William P. Crowley, Karen R. Kuff
and Juergen Reinhardt

1975

State of Maryland
Department of Natural Resources
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director
The Johns Hopkins University
Baltimore, Md. 21218